

CLAIMS

What is claimed is:

1. A wheel, comprising:
 - a peripheral wheel rim;
 - a central hub with an hub flange;
 - a plurality of spokes extending between the rim and hub, wherein said spokes have a first portion connected to said rim and a second portion opposed to said first portion;
 - wherein at least one of said spokes is a duplex spoke, including two structural spans, each extending between said rim and said hub with a common portion connected to said hub flange;
 - wherein said at least one duplex spoke includes engagement means to directly engage said hub flange and said hub flange includes engagement means to directly engage said duplex spoke engagement means;
 - and wherein said hub flange engagement means includes means to provide relative slippage control between the hub flange and the duplex spoke engagement means.
2. A wheel according to claim 1, wherein said wheel is a tension-spoke wheel, including spoke pre-tension.
3. A wheel according to claim 1, wherein said duplex spoke is assembled to said hub flange in a generally radial direction for connection between said duplex spoke and said hub flange.
4. A wheel according to claim 1, wherein said duplex spoke is assembled to said hub flange in a generally axial direction for connection between said duplex spoke and said hub flange.
5. A wheel according to claim 1, wherein said duplex spoke is assembled to said hub flange in a generally tangential direction for connection between said duplex spoke and said hub flange.

6. A wheel according to claim 1, wherein said hub flange includes a reinforcement element, wherein said reinforcement element provides compressive strength reinforcement to the hub flange to resist spoke tension loads induced by said duplex spokes.
7. A wheel according to claim 1, wherein said two structural spans of said duplex spoke are axially offset from each other.
8. A wheel according to claim 7, wherein said spoke engagement means includes an offset kinked region adjacent the junction of said structural spans.
9. A wheel according to claim 8, wherein said wheel is a tension-spoke wheel, including spoke pre-tension and wherein said pre-tension induces flexure in said kinked region and wherein said flexure causes said duplex spoke to bear against said hub flange engagement means.
10. A wheel according to claim 7, wherein the distance of said axial offset is generally equal to the axial cross-sectional thickness of said duplex spoke in the region of at least one of said structural spans.
11. A wheel according to claim 7, wherein the distance of said axial offset is greater than the axial cross-sectional thickness of said duplex spoke in the region of at least one of said structural spans.
12. A wheel according to claim 7, wherein said duplex spokes includes a clockwise radiating span and a counterclockwise radiating span and wherein the clockwise radiating span of a first of said duplex spokes crosses past the counterclockwise span of a second of said duplex spokes.
13. A wheel according to claim 1, wherein said engagement means of said duplex spoke has matched surface-to-surface contact with said engagement means of said hub flange.

14. A wheel according to claim 1, wherein said duplex spoke includes a kink to create the engagement means of said duplex spoke.
15. A wheel according to claim 1, including an angle between said first and second structural spans wherein said angle, as measured radially outboard of said hub flange, is greater than or equal to 180 degrees.
16. A wheel according to claim 1, including an angle between said first and second structural spans wherein said angle, as measured radially outboard of said hub flange, is less than 180 degrees.
17. A wheel according to claim 1, wherein said duplex spoke includes an overmolded slug and wherein said engagement means of said duplex spoke is located on said overmolded slug.
18. A wheel according to claim 17, wherein said two structural spans of said duplex spoke are axially offset from each other.
19. A wheel according to claim 17, wherein said engagement means on said overmolded slug is generally perpendicular to at least one of said structural spans of said duplex spoke.
20. A wheel according to claim 17, wherein said engagement means on said overmolded slug extends in a generally axial direction.
21. A wheel according to claim 17, wherein said engagement means on said overmolded slug has matched surface-to-surface contact with said engagement means on said hub flange.
22. A wheel according to claim 17, wherein said overmolded slug constitutes a region of enlarged cross-section geometry as compared to the cross section geometry of the structural span of said duplex spoke.

23. A wheel according to claim 1, wherein said duplex spoke includes at least two of said duplex spoke engagement means and wherein said hub flange includes at least two of said hub flange engagement means and wherein a first of said engagement means of said duplex spoke is engaged to a first of said engagement means of said hub flange for relative slippage control between said duplex spoke and said hub flange in one tangential direction and wherein a second of said engagement means of said duplex spoke is engaged to a second of said engagement means of said hub flange for relative slippage control between said duplex spoke and said hub flange in the opposite tangential direction.
24. A wheel according to claim 23, wherein said at least two engagement means of said hub flange are axially staggered with respect to each other.
25. A wheel according to claim 23, wherein said at least two engagement means of said hub flange are arranged to create a wedging engagement with the said at least two engagement means of said duplex spoke.
26. A wheel according to claim 25, including spoke pre-tension, wherein said spoke pre-tension serves to press said at least two engagement means of said duplex spoke against said at least two engagement means of said hub flange to augment said wedging engagement.
27. A wheel according to claim 1, wherein said hub flange includes an open cavity for engagement with said duplex spoke.
28. A wheel according to claim 27, wherein said open cavity includes two open ends, with said first of said structural spans extending through a first of said open ends and a second of said structural spans extending through a second of said open ends.
29. A wheel according to claim 27, wherein said open cavity includes a generally radially extending spoke bracing surface, wherein said duplex spoke contacts said spoke bracing surface.

30. A wheel according to claim 28, including at least two of said spoke bracing surfaces, wherein a first of said structural spans contacts a first of said spoke bracing surfaces and wherein a second of said structural spans contacts a second of said spoke bracing surfaces.
31. A wheel according to claim 27, wherein said open cavity includes at least two recesses, wherein a first of said recesses is engaged with a first structural span of said duplex spoke and wherein a second of said recesses is engaged with a second structural span of said duplex spoke.
32. A wheel according to claim 31, including an axially extending gap between said first recess and said second recess for passage of said duplex spoke.
33. A wheel according to claim 1, wherein said hub flange is made of polymeric material.
34. A wheel according to claim 33, wherein said polymeric material includes reinforcement fibers.
35. A wheel according to claim 1, wherein said duplex spoke includes a continuous structural element, wherein said continuous structural element includes said two structural spans and includes at least a portion of said common portion.
36. A wheel according to claim 35, wherein said continuous structural element is made of metallic material.
37. A wheel according to claim 35, wherein said continuous structural element includes high strength reinforcement fibers.
38. A wheel according to claim 37, wherein said high strength fibers are impregnated within a polymer matrix.

39. A wheel according to claim 38, wherein said polymer matrix is a thermoplastic polymer matrix.
40. A wheel according to claim 37, wherein said high strength fibers are continuous fibers that extend through said common portion.
41. A wheel according to claim 1, wherein said spoke engagement means has a region of variable cross section geometry, wherein said variable cross section geometry provides an overlying engagement with the hub flange.
42. A wheel according to claim 41, wherein said region of variable cross-section geometry is an integral portion of said duplex spoke.
43. A wheel according to claim 41, wherein said variable cross section geometry includes a projecting portion extending outwardly from said spoke that engages a projecting portion extending outwardly from said hub flange.
44. A wheel according to claim 43, including a spoke extension affixed to said duplex spoke, wherein said spoke extension includes said projecting portion of said spoke.
45. A wheel according to claim 1, wherein said wheel includes a plurality of said duplex spokes.
46. A wheel according to claim 1, including an auxiliary member, wherein the auxiliary member serves to at least one of retain, engage, and clamp said spoke to said hub flange.
47. A wheel according to claim 1, including an intermediary member, wherein said spoke is engaged to said intermediary member and said intermediary member is connected to said hub flange.

48. A wheel according to claim 1, wherein means to provide said relative slippage control comprises duplex spoke engagement means operative to provide bracing against spoke tension and to transmit torque between the hub flange and the spokes.